

### Shape -

- 1) definite proved orientation for types of movements.
- 2) form adapted to joint structure
- 2) position of muscles.
- 3) least expenditure of force.

### Form -

- 1) economy of energy.
- 2) attainment of movement.
- 3) buoyancy & elasticity.

### Muscular activity -

- must know metabolic process.
- 1) respiration & heart action increased.
- 2) metabolism & nutrition affected.

### Fatigue -

- 1) breathlessness.
- 2) use of effort & pressure under muscular contractions.

### Heart -

- strengthened by exercise.
  - beats faster. - rate increases.
  - waste products act as hormones, nerves & brain stimulated & heart beats faster.
  - blood vessels dilate & contract. (arteries)
- Athletes fast heart.
- arteries thicker.

Chap. 3.

## The Effect of Bodily Exercises on Bone & Joints

Framework moves through muscle pull.  
Muscles - motor organs. | affected by  
Joints - passive organs. | increase

Bones - growth from ends.

length - calcium deposits under cartilage  
of joint. (increases 5 times)

thickness - periosteum. (rickets)

Growth - stimulated by pressure - effects  
of joints of short duration.

- increase blood supply at bone ends
- increase nutritional substances  
& salts

Bone growth - by muscle pull.

(tuberosities, ridge edges.)

- periosteum - ~~thickness~~ of bone wall.

Bone structure.

- form bony ring.

- tiny osseous fibers support ring  
(give resistance & lightness.)

Bone deformity. (pulling or pressure)

Rhaphosis - posterior thoracic curve.

Sinx | Kyphosis - lumbar curve.

Scoliosis - lateral curve.

Curvatures -

- change shape of spine & surpass of  
vertebrae.

- due to 1) faulty posture

2) one-sided hardening of spinal column

- Associated with
  - 1) lowered body vitality.
  - 2) power of resistance.
- Exercise should
  - 1) develop upright posture.
  - 2) stimulate growth of bones & ligaments of spine
  - 3) strengthen weak back muscles.

### Posture:

1. Fatigue
2. Occupation
3. Mental attack
4. Malnutrition

Muscle is life of muscle.

- control nervous reactions

- every fibre of muscle is stimulated.

Tendon - elongation of muscle.

- made of connective tissue - non-elastic.

- pt. attack - of muscle to bone.

long muscle - motion

short - - strength + support

long thin - - protection + support

Built for function.

Muscles of shoulder-joint - rt. ad. + ab.

hand - grasping

abdomen -

back -

Breathing - by muscle action.

Inlet - costals -

- Contract & pull ribs up.

### Action Pressure

Muscular contraction

- nervous stimulus - relaxation.

Muscle twitch

- whole contraction of muscle.

Empathetic responses

- imitation of another person.

Muscle curve

- latent period  
contraction  
relaxation

Muscle僵化-

CO<sub>2</sub> in muscles - stiffness

Absolute muscle strength

Scientific muscle strength.

Muscle - contraction

glycogen + O<sub>2</sub> + stimulus →

Rest - CO<sub>2</sub> + lactic acid + H<sub>2</sub>O.

Lactic acid -  $\frac{1}{2}$  - back to glycogen.

$\frac{1}{2}$  - expelled rest through  
lungs, skin, bladder.

Muscle tone.

Readiness to contract.

Destroys lack of exercise  
disease.

Removal of blood.

Blood returns from muscle to liver  
muscles & heart.

## Chap. 4.

## Effect of Bodily Exercise on Local Muscle Groups.

Voluntary muscles - to body not

- during exercise receive blood.
- arteries & capillaries enlarge to muscles & lungs.
- called skeletal muscles.
- contracted & stretched by will.

Structure:

- striated
- small bundles of muscle fibres
- at - nuclei - elongated
  - contain elements of growth & reproduction & repair.
  - enlarge muscle fibres.

2nd - sarcoplasm - albuminous.

3rd - muscle fibres.

4th - sarcolemma.

- contain blood vessels & nerves.
- blends with bone periosteum.

Tendons:

- strong muscle fibres - tissue.
- long & stiff.

Muscles

- long, band-like, spindle-like.

Sensitivity:

- shifted as feet move apart change direction.

Mt. transversum in walking

- heel, outer border of foot, toe.
- runs hind on sole of foot.

(heel retards speed.)

Shock absorbers of body:

- angular position of neck of femur.
- fibres of knee joint.
- intervertebral discs.

proprio- land on toes, land ankle, knee,  
hip joint + spine.

balance of trunk - muscles of thighs, hips,  
ankles, erector spinae.

81% - muscles of pubis + thigh - (legs)

28% - muscles of trunk, arm + hand.

327 muscles - int. + muscle mass.

quadriceps femoris.

macrospinatus  
deltoid, triceps +  
biceps brachii.  
pect. major.

glutens med.

gastrocnemius

adductor magnus

iliopsoas

glutens med.

### act of respiration

deep inspiration, fix shoulder blades.

- close the glottis + fix thorax.

- fix abdominal + intercostal muscles.

- offers base to moving muscles.

### Posture

- straight carriage.

- normal curves of spine - balanced body.

- head high + straight.

- chest pu + arched.

- shoulders not drooping.

### Round shoulders

- occipitofac.

- tight pectorals.

### Athompsia

- pinches elasticity to abdominal wall.

- muscles of respiration.

- draw thorax down.

- draw thorax down to pelvis.

- bend trunk forward.

- help rotate trunk.

- exert pressure on alimentary canal.

Respiration - exchange of gases in lungs.  
internal respiration - gasses exchange of inside.

internal r. - gasses exchange of lungs.

medulla oblongata - tests blood & regulates O<sub>2</sub> & CO<sub>2</sub> balance by nervous system.

CO<sub>2</sub> acts as a hormone.

Heart beats faster - action of CO<sub>2</sub> acts as a chemical hormone in medulla.

Dilation of heart - stored blood in veins rushes into heart & expands it.

Metabolism - breaking down + building up body.  
- controlled by:

1) thyroxin

2) exercise & food

3) weather

carbs - starches sugars - glucose - glycogen.

protein - amino acids

Work - ~~at~~ x mt - x distance

Metabolism - can be trained.

- body learns to utilize food better.

Work - mountain climbing, bicycling  
endurance.

Nerve - 1st. stimuli does not produce maximum contraction

## Chapter 5.

### The Physiological Processes in Muscular Work and the Influence of Exercise upon them.

#### Exercise.

Voluntary muscles contract.

- made up of small fibres.
- afferent nerve - contract
- sarcoplasm - fibrils.
- covered with sarcolemma.
- in bundles - membrane contains vessels & nerves.
- covered with fascia.
- composition - protein, fat, salts, water.
- combination  $H_2O + protein$  - called combination

Denseness & contractability.

- main changes in cell - salt sol. presence.
- nerves stimulate change.
- cause shortening of fibres. ∴ whole muscle
- only enough fibres contract.

Muscle twitch.

- muscle contraction - amt. of mechanical work performed.
- contraction curve - state is moved past touching line.
- time of contraction is not simultaneous with received stimulus.

latent period.

- muscle prepares for contracting after stimulation.
- increased by fatigue & mt. increase.

### Tonic contraction

- continued contraction or nerve stimulations.

### Tetany

- latent period becomes longer
- minimum of contraction occurs later.
- work of muscles slower, curve lower.
- no muscular energy "muscular fatigue".

### Tension

- mt. to great pr muscle.

### Isometric tension - (sustained work)

- shortening of stimulated muscle prevented
- no work done.

### Isotonic

- muscle in action maintains some tension during work.

Most contractions - mixture of both.

### Fine work muscles

- richer in sarcoplasm - pr in fibrils.
- slower (twitching) - economizes energy.

### Rest tone

- tonic & contraction kept up by a reflex developed through its own lengthening.
- sensory nerves tell brain of lengthening.

### Metabolism

- carbohydrate in cell - changes.
- amt. of glycogen reduced - lactic acid h.

### Lactic acid -

- produces contraction - by acting chemically on fibrils.

1) -  $\frac{1}{2}$  with O<sub>2</sub> changes to - H<sub>2</sub>O + CO<sub>2</sub>

$\frac{4}{5}$  changes glycogen.

2) (heat from body)  
360 (used by formation of H<sub>2</sub>O + CO<sub>2</sub>)

- 2) Transformation by help of phosphoric acid.  
glycogen + Pacid - lactacidogen.  
- which produces energy.  
- excreted by urine.

Lactate collects when O<sub>2</sub> cut off

- process caused by nerve stimulus.
- running caused most lactic acid pro.
- greatest collection of lactic acid  
8-9 minutes after exertion.

Glycogen decomposed by

- 1) lactic acid
- 2) CO<sub>2</sub> - formed by lactic acid + O<sub>2</sub>.

Breathlessness

- CO<sub>2</sub> inhalation greater than O<sub>2</sub> intake.
- respiratory muscles fatigued.

Muscle fatigue

- lactic acid + lack of O<sub>2</sub> weakens muscle.
- muscle must build new lactacidogen to function on.
- protein split produces fatigue burning in large muscle groups.
- kidneys influence in fatigue.  
- eliminate protein r. + w. muscles casts & wastes.

Rest to working muscle

- increases no. of contractions.
- sends out more blood - each contraction.
- arteries enlarged - nerve stimulation.
- capillaries enlarge.
  - through self-active cellular elements.
  - by influence of protein in blood.



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